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Economic assessment of treated feed with certain ingredients in crossbred dairy cattle under sub-tropical conditions

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Abstract
In order to reduce the cost of feeding in crossbred dairy cattle experiment was conducted with a total of 24 crossbred animals (8-12 months of age). Animals were randomly allocated to four different groups(6 animals per group) *viz*. Group-1 (Gr-1): 100% treated leftover feed; Group-2(Gr-2): 75% treated feed; Group-3 (Gr-3): 50% treated feed and Group-4(Gr-4) or Control: 100% green fodder. The leftover feed F-1, F-2, F-3, F-4, F-5 and F-6 were treated with combination of 1% urea+5% molasses+0.5% salt, 1% urea+5% molasses+1% salt, 1% urea+10% molasses+0.5% salt, 1% urea+10% molasses+1% salt, 5% molasses+0.5% salt and 10% molasses+0.5% salt, respectively. The average feeding cost per animal at farm was 80Rs. under normal circumstances whereas feeding cost in 1st group was 36Rs, 37Rs, 70Rs, 70Rs, 35Rs, 69Rs respectively in F1, F2, F3, F4, F5, F6 groups. Which gave a reduction of 44Rs, 43Rs, 10Rs, 10Rs, 45Rs, 11 Rs. respectively. For 2nd group it was 50Rs, 51Rs, 70Rs, 71Rs, 50Rs, 70Rs respectively for F1, F2, F3, F4, F5, F6 treatment groups which gave a reduction of 30Rs, 29Rs, 10Rs, 9Rs, 30Rs, 10Rs respectively and for 3rd group it was 60Rs, 61Rs, 75Rs, 75Rs, 60Rs, 75Rs for F1, F2, F3, F4, F5 and F6 treatment groups respectively which gave a reduction of 20Rs, 19Rs, 5Rs, 5Rs, 20Rs and 5Rs respectively. These data clearly shows that there was significant reduction in feeding cost of animals.

Keywords: Cost, economics, leftover feed, molasses, palatability, urea, Vrindavani

1. Introduction
At present there is a shortage of 35.6% green fodder, 10.95% dry crop residues and 44% concentrate feed ingredients. However there is abundance of dry roughages throughout the year because roughages remain in the rumen for longer period of time. The productivity of animals can be increased by utilizing these resources without impacting the health of animals as well as their welfare. But these things require good techniques time to time assessment. Large dairy animals mainly subsist on green fodder, dry roughage and concentrate mixture. Investment in the dairy sector comprises 60-70% feeding cost which means there is huge scope in this avenue to reduce the cost of rearing if innovative techniques are. Cattle manure sometimes used but to very little avail. Leftover feed is considered as waste and discarded in majority of farms and households in India. The components of this waste varies, which depends upon the availability however by and large the leftover consist mainly of Maize, Sorghum, Millets, Clover and Napier grass in northern plain region of India (Birthal and Jha, 2005) [2]. It has been reported that if molasses and urea mixture is supplied to the animals with straw then feed intake, digestibility and palatability of rice straw increases (Sahoo *et al*., 2004; Verma *et al*., 2006) [16, 21]. Studies that are conducted for this purpose by treating the low quality feed with urea, ammonia and molasses with different inclusion levels which provided positive results. It was observed that urea treatment could increase nutritive value of straw by 46% (Wanapat *et al*., 2009) [22] due to breakage of bonds between the lignin, hemi-cellulose and cellulose. The feeding practices using these feed have also improved the productivity of dairy animals (Singh *et al*., 2014) [20]. From the perusal of literature, it is found that the most of earlier research works have been targeted on treatment of dry residues (wheat straw or rice straw) using supplementation of urea as nitrogen or molasses as energy sources but no study has been conducted on treatment of the fresh leftover feed having high moisture contents (more than 50 per cent). The treatment of leftover feed using different combinations of urea, molasses and salt may enhance its nutritive value.

This enhanced quality feed serves as better feed during the scarcity or weak period of fodder availability. It also helped in reducing the feeding cost without affecting the performance of animals.

2. Material and Methods

2.1. Place of study

The study was conducted at Cattle and Buffalo Farm, ICAR-Indian Veterinary Research Institute, Izatnagar, India, which is located at latitude of 28° 22' north, longitude of 79° 24' East and altitude of 169.2 meter above the mean sea level. The location comes under upper Gangetic plain region and has sub-tropical climatic condition with high humidity, especially during the winter season. Weather turns colder during winter stretching from November to February whereas summer ranges from May to August months annually. The annual rainfall ranges from 90 to 120cm and most of which are received during the months of July and August.

2.2. Design of experiment

Different combinations of treated leftover feed with fresh fodder was tried to reduce the cost of feeding. The waste feed consisted of chaffed fodder Sorghum, Millets, Maize, Napier grass and Berseem (clover) as raw material. Six combinations of urea, molasses and salt were used for treating the leftover feed (Table 1) to increase its nutritive value and reduce feeding cost.

Table 1: Six different combinations of urea, molasses and salt used for treatment of leftover feed

Basal feed material (on fresh matter basis)	Chemical substance (on dry matter basis of basal feed)			Treated feed (end product)
	Urea	Molasses	Salt	
Leftover feed	1%	5%	0.5%	F1
	1%	5%	1%	F2
	1%	10%	0.5%	F3
	1%	10%	1%	F4
	Nil	5%	0.5%	F5
	Nil	10%	0.5%	F6

2.3. Selection of experimental animals

A total of 24 crossbred animals (8-12 months of age) were selected and randomly allocated to four different groups (6 animals per group) *viz*. Group-1 (Gr-1): 100% treated leftover feed; Group-2(Gr-2): 75% treated feed; Group-3 (Gr-3): 50% treated feed and Group-4(Gr-4) or Control: 100% green fodder, without use of treated feed. Feeding was done for 7 days in four different proportions (Table-2) of treated and fresh green fodder.

Table 2: Feeding trial using different combination treated leftover feed and green fodder

Feeds	T1 group	T2 group	T3 group	T4 Control
Green: Treated leftover feed	0: 100	25:75	50:50	100:0
Concentrate feed	Provided equally in all groups (As per institute feeding protocol)			

All the 24 animals were weighed before and after each feeding trail and their weight gains were compared after the end of each trial.

2.4. Chemical analysis of feed

Leftover feed was analysed before and after treatment by proximate analysis to find out changes in the nutritive values (crude protein, crude fibre, moisture, dry matter and ash content). The presence of fungal toxins *viz*. mycotoxin and ochratoxin were also tested in the treated feed.

2.5. Performance of the animals

Performance of the animals was evaluated based on weight gain before and after each feeding trail.

2.6. Statistical Analysis

The data obtained from the experiments were analysed using the SPSS 20.0 software package.

3. Results

3.1. Economics of the feed

Economic feasibility of the treated feed in different groups were measured by using scorecards as mentioned in Table-3

Table 3: Average feeding cost (in Rupees) of all the treatment groups

Groups	F1 feed	F2 feed	F3 feed	F4 feed	F5 feed	F6 feed
Group 1	36	37	70	70	35	69
Group 2	50	51	70	71	50	70
Group 3	60	61	75	75	60	75
Group 4	80	80	80	80	80	80

Feeding cost chart shows that there was reduction in feeding cost up to the extent of half in 1st and 2nd treatment groups feeding cost was somewhat higher in 3rd treatment group due to higher cost of molasses but even though it was lower than the control group and also feasible and can be well utilized. Among the treatments, the combinations of treated and fresh feed (in ratio of 50:50 and 75:25) gave better results in terms of feed acceptability without any adverse effect on performance of the growing animals.

4. Discussion

4.1 Feeding cost of animals

When the leftover feed was reutilized it is seen that there is significant reduction in feeding cost without affecting the performance of the animals during the growing stage as was evident from the scorecards, there was least cost involved in 1st group of animals but due to higher concentration of urea in the feed it was less palatable whereas treatment cost was highest in 3rd group which was most palatable it was due to higher cost of molasses and its higher involvement. The 3rd group showed the most moderate and good results as the feeding cost was also low and it was palatable also and hence most recommended.

4.2. Proximate analysis of feed

Proximate analysis of feed showed increase in nutritive value of the after every treatment which was due to urea ammoniation of leftover feed and increased content of carbohydrate, molasses, ash was due to minerals present in salt and other impurities present in premix. The increase in

crude protein and crude fibre content is in agreement with Gordon and Chesson (1983) [5] and Sarwar *et al.*, (2010) [19] who found higher crude protein and total protein content of barley or wheat straw being treated with 4% urea. Results are also in line with Saadullah *et al.* (1980) [15] who reported increase in crude protein content of rice straw from 2.9 to 5.9% when treated with 3% urea and CP content increased to 6.7% when treated with 5% urea. Hassan *et al.* (2011) [6] reported high ruminal NH_3-N in bulls fed urea treated straw. Fike *et al* (1995) [3] and Dass *et al.*, (2000) [3] reported increase in crude protein by urea ammoniation of wheat straw whereas higher digestible protein and digestible nutrients were recorded by Prasad *et al*., (1998) [13] in rations containing either stacked or baled urea treated rice straw. Treatments fifth and sixth contained only molasses and salt and they had sweet smell and golden brown colour so their palatability was comparatively better. Sahoo *et al*. (2002) [17] reported that organic matter, neutral detergent fibre and hemicellulose digestibility were highest in urea treated wheat straw. Similarly, many reports say that urea treated wheat straw increased the ruminal NH_3 concentration in (Manyuchi *et al.*, 1992; Nisa *et al.*, 2004; Sarwar *et al.*, 2004; Jabbar *et al*, 2008) [9, 11, 18, 7].

4.3. Performance evaluation of animals

Initial weights of the animals were non-significant, final weights were also non-significant but there was significant difference in weight gain of the animals in treatment groups for F3 and F5 feed in which lower weight gain than the other three groups were observed which might be due less palatability of treated feed than that of fresh green fodder. The equivalent performance in Gr-2 might be due increased nutritive values of feed along with acceptability and better palatability in control group (Garg *et al*, 2006) [4]. Kilic and Emre, 2017 [8] reported that digestibility of wheat and soybean straw could be improved upon some additives however in present study feed palatability was taken in account for performance evaluation along with weight gain. Mishra *et al.*, (2012) [10] found that supplementation of urea molasses block significantly increased the milk yield, live weight and body score of cows. Similarly, the enhanced acceptability of feed upon treatment with molasses was observed in crossbred heifers (Pathak *et al*., 2015) [12] and lambs (Rath *et al*., 2001) [14].

5. Conclusions

Treatment of left over feed using different combinations of urea, molasses and salt was economic and feasible and also increased nutritive values in terms of crude protein and fibre contents without production of fungal toxins like mycotoxins and ochratoxins. The animals fed on 50 per cent treated feed and 50 per cent fresh green fodder had equivalent palatability and weight gain in compared with control group and also had very low feeding cost. The leftover feed can efficiently be utilized for feeding to various classes of dairy animals under farm conditions to minimize the rearing cost and could also serve a better option during the scarcity period of fodder production.

6. Declarations of interest

The authors report no conflict of interest over the content of this paper.

7. Acknowledgements

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